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Knowledge of Atoms and Void in Epicureanism

D. J. Furley

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There is an obvious paradox in the theories of the Atomists. They held that nothing exists but atoms and void, and that the atoms are imperceptibly small, and invariant in quality. The thinking part of a man is composed of these materials and no others; his thinking can only be a function of the motions of invariant atoms. Knowledge of the external world must be some kind of reaction between the atoms of the external world and the atoms of the thinking man; and the only reaction in the atomist's theory is simply collision. That is to say, the connexion between the thinking subject and the external world is nothing but touch: "tactus enim, tactus, pro divum numina sancta" as Lucretius strenuously insists (2. 434). The Atomists are then ready to show how all our senses are really varieties of the sense of touch; each faculty of sense is stimulated by actual contact with suitable formations of atoms proceeding from the external world.

It is a picture which has a certain plausibility as a theory of sensation. And the atomists liked to say that sensation is indeed the basis for all our contact with the external world. The paradox of course is this: if knowledge comes to us by means of sensation, how are we to explain the atomist's knowledge of the basic propositions of his special theory: that the world consists of void, which is called "the intangible", and atoms, which are said to be imperceptibly small? It is a question which arises with regard to the earlier Atomists and the Postaristotelians; but this paper deals only with the latter.
One answer to the question has acquired authority during the last few decades of classical scholarship, and I want first to examine it. Its best known statement is in the work on Epicurus by Cyril Bailey. According to Bailey, the Epicureans believed in a form of direct knowledge of the external world which bypassed sense perception. It was a sort of focusing of the mind analogous to focusing the eyes, straining the ears, dilating the nostrils (and presumably doing whatever one does do to the tongue and the skin for the other two senses).

Bailey correctly drew attention to a striking difference in what Epicurus said about the two classes of subjects which he grouped together under the heading adelai (non-evident). Meteorology and the stars were one such class; Epicurus asserted that since we cannot get the close view and since many explanations of the same phenomenon are often equally in conformity with our observations, the philosopher must hold all these explanations to be equally true. To prefer one to the others, he said, would be to plunge into mythology. And everybody knows that the Epicureans exhibited something like relish in offering multiple explanations for these things.

However, the fundamental principles of the atomic theory, such as the statement that there exist atoms, that there is void, that there is no third sort of being, and so on -- these are also adelai, in that they are not accessible to direct sense-perception. But in this case, the Epicureans accepted no multiple explanations: just one theory was right, and one could accept it confidently.

What was the Epicureans' justification for this certainty? Bailey thought he had found the answer in the expression used by Epicurus with some frequency but without definition: "epibole tes dianoias". I quote from Bailey:
"Thought -- or reasoning -- about the ultimate realities of the world is conducted by the comparison and combination of "clear" concepts, each stage in the process being a new concept recognized as self-evident. These concepts are grasped by 'an act of apprehension on the part of the mind' (epibole tes dianoias) exactly similar to that by which the senses apprehend the 'clear vision' of the near object, or the mind the subtle images which penetrate to it."

This assertion was defended in a long appendix on epibole tes dianoias which Bailey put at the end of both of his books on Epicurus.

Striking use of Bailey's explanation was made by Cornford, in the second chapter of his Principium Sapientiae, where he attacks the verdict of some writers that Epicureanism was one of the most "scientific" of ancient philosophical systems. Cornford says: "A system which professes to rest on the testimony of the infallible senses might be expected to put forward only a tentative hypothesis about the wholly imperceptible, and to recommend suspension of judgment . . . But Epicurus' attitude is exactly the reverse of this sceptical caution: he is more dogmatic in this field than in either of the other two . . . 'Atomism is not one among several possible theories of the universe, nor with regard to any of its details is there a hint that any other view than that expounded by Epicurus himself could be true,' (Bailey GAE 265). Epicurus is content to assert roundly that his atomism is the only theory consistent with phenomena."

A curious feature of this appreciation of Epicurus is the way in which it ignores some of the evidence, and distorts the rest. "How did Epicurus suppose we come by our knowledge of atoms and the void?" Bailey asks. But he does not look for the answer in the obvious place: namely, in the text in which Epicurus
defends his basic propositions. Instead he seizes upon the obscure phrase *epibole tes dianoias* and manipulates the contexts$^7$ in which it appears until they seem to justify his theory of direct mental apprehension.

It must be conceded first that the notion of direct mental apprehension does play a part in Epicureanism. What I want to deny is only that it plays the supremely important part in the foundations of the atomic theory that Bailey has given to it.

There is enough textual evidence in Epicurus himself and Lucretius to show that the Epicureans held that certain *eidola*, of the same kind as the *eidola* which cause sense-perception, do not stimulate the senses, because they are too fine (*leptos*), but rather penetrate directly to the soul-atoms of the mind.$^8$ There they may produce a phantasia or image, which is similar to the images produced by sensation. The experiences which the Epicureans hoped to explain by this thesis were dream-visions, certain types of imagination (in the modern sense), and especially ideas about the gods.

The texts which serve as our evidence for this theory do not speak of the fundamental propositions about atoms and the void. It is my belief that this theory was strictly limited to the explanation of those experiences with which it is associated in the surviving texts.

The inflation of *epibole tes dianoias* into a kind of intuitive knowledge which includes knowledge of the fundamental propositions of atomism can be punctured by the study of one text in particular. This text is in the right place: that is, it is no obiter dictum, but centrally placed in the Letter to Herodotus, § 50-51, in the passage that deals with our knowledge of the external world. To my mind all the editors misunderstand it.$^9$
Whatever image, of shape or of properties, we set by apprehension of the mind or the senses, this is the share of the solid object, when it comes about because of the successive repetition of the *eidolon*, or because of the remaining effect of the *eidolon*.10 ουβ.

But falsehood and error always lie in the addition made by *doxe* . . . 11 ουβ.

For there would have been no similarity between the appearances seen as if in a picture or occurring in dreams or in any of the other apprehensions (*epibolai*) of the mind or of the other criteria, and things which really exist and are called true, unless these things that we apprehend really existed.12 ουβ.
But the error would not have happened if we did not have a second motion, in ourselves, connected with the apprehension of the image, but different from it; in this motion, if there is no confirmation, or refutation, error arises, and if there is confirmation or no refutation, truth.
Sentence A of this text is about reliable perception and mental apprehension. It might perhaps be thought that the word epibletikos mentions the necessary and sufficient condition for reliable perception; but this need not be so. The conditions for reliable perception are mentioned in the clause beginning ginomene. Mental images (phantasiai) are reliable when they are produced by the successive repetition of the eidolon (that is, when a constant stream of eidola comes from the external object to the perceiver, as when one is directly looking at the object), or when they come about through what is left behind by the eidolon (that is, the pattern left behind as a memory by previous sense-experience). The word epibletikos means no more than "by the apprehensive process", the process by which the mind or the senses "get hold of" something. This is confirmed by a fragment of the lost work of Epicurus On Nature, where the epibletikos tropos is contrasted with "proceeding from oneself alone" (29.15.8).

Sentences B, C, and D are all about illusion. This is the point missed by the editors, who believe that C is about reliable perception. The passage as a whole is telling us something essentially simple, and it runs like this:

Sentence A (following a description of the eidola and their reception by the perceiver): The image that results from the apprehension of eidola, when it comes from a succession of eidola, not just a random one, or when it corresponds to a memory image, reproduces the shape of the external object which produced the eidola.

Sentence B. Error is not in the act of apprehension, but in a subsequent movement of the soul, called doxa.

Sentence C. The misleading resemblance between dream-images and other illusory appearances on the one hand and what is true and real on the other --
the resemblance which leads into the error of supposing that the illusion is
the truth -- exists because illusory images, as well as reliable images, are
produced by the apprehension of real eidola (real eidola, we have to understand,
but not in a steady succession). 16

Sentence D. Error occurs when such an image is wrongly assessed by doxa --
the "second opinion" (sc. of soul atoms) "in ourselves": it is treated as a
clear image, resulting from a steady stream of eidola, when it is not.

Here, then, epibole tes dianoias occurs in the explanation of illusions
of many kinds. This surely should have been enough to give Bailey pause. What
kind of a concept is it that is both the explanation of illusory dreams and
visions, and the guarantee of scientific truth? If this phrase is to mean "an
act of deliberate attention" is it not disconcerting to find it in an account
of dreams?

At this point we can turn to the other approach to Epicurus' idea of his
knowledge of the atomic theory: that is, the method of argument used to defend
it. First, it may be worth saying that Bailey and Cornford were probably
distracted from this approach by the notion, which seems to me mistaken, that
we must look for the distinguishing characteristics of an empirical theory in
the manner in which the theory is first reached, rather than the manner in which
it is defended. As against this, I agree with Popper, who wrote at the begin-
ing of his Logic of Scientific Discovery, "The question of how a new idea
occurs to a man . . . may be of great interest to empirical psychology; but it
is irrelevant to the logical analysis of scientific knowledge." 17

The relevant section of the Letter to Herodotus is preceded by a methodo-
logical note: "We must control all our investigation by the sensations and by
the immediate apprehensions (epibolai) either of the mind or the various other
criteria, likewise by the immediate feelings, so that we can make inferences
about that which is in suspense and about things which are unclear." 18
He continues at once: "About things that are unclear, we must get the following points made and keep them in mind. First that nothing comes to be out of that which does not exist; for everything would in that case be coming into being with no need of seeds."

Notice the very simple method: he asserts his thesis, then makes its contradictory the protasis of a conditional statement, of which the apodosis is a proposition falsified by sense-perception. "P. For, if not-P, then Q, which is observed to be false".

We have very nearly the same pattern repeated frequently, and especially in the argument for the existence of void, which became famous and much talked about in antiquity -- indeed it was famous before Epicurus used it at all, for it was used in the reverse direction by the Eleatics, and was almost certainly borrowed from them by Leucippus and Democritus.

First Epicurus notes that the existence of somata is confirmed by the direct evidence of the senses, "which we must use for making inferences about what is unclear by reasoning (logismos)". He goes on, "If there did not exist that which we call void and space and untouchable nature, bodies would have nowhere to be or to move, as they are observed to move."

The schema is this: "Void exists: for if void did not exist, there would be no motion, which we observe to be false."

A century or more after Epicurus, when Stoic logic was developed into a systematic study, this pattern of inference was formalized and grouped with other similar patterns. It is in fact the second of the undemonstrated arguments collected by Benson Mates (Stoic Logic, p. 71): "If the first, then the second Not the second; therefore not the first," with negative propositions substituted for the propositional variables.
The Stoics, with their new interest in logic and epistemology, attacked the Epicureans. Although the Epicureans were probably never much interested in logic as such, they evidently felt impelled to offer some sort of reply to Stoic criticism. We have evidence of their replies in the Epicurean work by Philodemus, called On Signs, which partly survives in the form of badly mutilated papyrus fragments. It was published by Gomperz in the 1860s, and there was a further study of it by Philipson in 1909 and 1910, so there was no excuse for Bailey's total neglect of it in his books on Epicureanism; though of course he did not have the advantage of Professor DeLacy's edition of it. This book should at least be scrutinised for any evidence it may provide on the way the Epicureans thought about the epistemological basis of their theory. Like all the Herculaneum papyri which contain Epicurean material (at least, those so far unrolled and read), Philodemus' On Signs has very limited value. What it does show is that a debate went on about the validity of inductive inference. The Stoics, it appears, wanted a logic of science based on the model of Aristotelian apodeixis, in which only necessary truths would be admitted. Hence they claimed that the implication "If there is motion, then there is void" was valid, only if it was contradictory to deny the second and assert the first; i.e. only if void were somehow involved in the definition of motion. The Epicureans replied with an insistence that the inference is empirical, not analytic. "We study all the things that move in our experience and we reckon up the accompanying conditions, without which we see nothing move; and we claim that everything that moves, moves like these things, and so infer that there cannot be motion without void."21

Now, these Epicurean arguments are no doubt naive and lacking in scientific precision. But they do not, so far as I can see, suggest that knowledge of the proposition "there is void", and of the other basic proposition of the atomic
theory, was thought to depend upon some kind of direct mental perception called epibole tes dianoias. Of course, the Stoics had a point when they said that the arguments which moved from instances in our experience to instances outside our experience depend on the assumption that there are uniformities in nature. But this is clearly only a weakness if you demand analytic truth in the realm of empirical knowledge.

However let us look at some Epicurean arguments of a different type, where the appeal to sense-perception is less obvious.

One example is the argument with which Epicurus supports his theory of to en te atomo elachiston, or minimaes partes, as Lucretius calls them.\textsuperscript{22} There are other ways of reading this argument, but if I am right about it, it includes the following: Suppose that an atom contains infinitely numerous parts, each of them having size: it is impossible, in that case, to see how it can still be finite in size, since the parts must all be of some size, and if they are infinitely numerous, the total must be infinitely large. Hence we must not suppose that the atom is infinitely divisible.

This argument contains the expression ouk esti noesai, "it cannot be thought", "it is impossible to see". Does this indicate some appeal to a kind of direct intuition? Are we perhaps supposed to make use of the epibole tes dianoias, and rely on its negative report: "It is not possible to see how a finite body can have infinitely numerous parts"?

No. Epicurus continues at once with an appeal to sense-perception. There is a minimum visible quantity: one cannot -- experience shows that one cannot -- divide a visible area into infinitely numerous parts. We must believe that the sub-visible area, which is accessible only to the theorising mind, follows the same pattern as the visible one.
It is interesting that there are two analogies in this argument, one of which is supposed to hold while the other is not. Epicurus uses the analogy between the visible and the intelligible: he regards this as valid. But we might suppose that there is likewise an analogy between the minimum and multiples of the minimum in the visible field, and conclude that because we can distinguish parts of something that is larger than the minimum we must be able to distinguish parts of the minimum itself, since it is the same kind of stuff. This analogy obviously has to be rejected. Epicurus goes on at once to reject another one: if we say the atom has parts, we might be tempted to think that it could be resolved into its parts like compound bodies in the sensible range: but this again is obviously false. The reason why the analogy can be seen to be invalid on both these cases is just that the conclusion yielded by the analogy has already been falsified by another argument. We know already that there is a minimum visible quantity, and that atoms are indissoluble.

This passage may perhaps throw some light on another part of the Letter to Herodotus: an obscure remark which Bailey used as the main prop to support his argument about epibole tes diadoias. 

The subject is this. Epicurus has just asserted that atoms moving in the void all move at the same speed, in whatever direction they are moving. Compound bodies, however, are seen to move at different speeds. How can this be? The answer is that though the compound appears to move all in a solid mass, it is in reality composed of atoms and void, and within its surfaces its component atoms are moving to and fro in all directions all at constant speed. The speed of motion of a compound body depends on the overall direction taken by its component atoms during a stretch of time. Now, suppose we have a compound moving from A to B, a distance of one metre, in 100 seconds. Then all its component atoms have moved one metre in that direction in 100 seconds. It is
natural to suppose that each atom therefore moves one centimetre in that
direction in one second, one millimetre in one tenth of a second, and so on.
But this would be false. If we take the smallest time-intervals, each atom
may be moving in any direction whatever.

This is how Epicurus concludes the paragraph:
τὸ γὰρ προσδοξαζόμενον περὶ τοῦ ἀοράτου, ὡς ἀρα καὶ οἱ διὰ
λόγου θεωρητοὶ χρόνοι τὸ συνεχὲς τῆς φορὰς ἐξουσιάν, οὐκ ἀληθές
ἐστὶν ἐπὶ τῶν τοιούτων. ἐπεὶ τὸ γε θε τραύματον πᾶν ἡ κατ’
ἐπιβολὴν λαμβανόμενον τῇ διανοῇ ἀληθῆς ἐστὶ.

The inference of doxa about the invisible, namely that
the time intervals that can be examined (only) by means
of theoretical reasoning will also retain that continuity
of motion (sc. which is observed during perceptible time
intervals), is false in such cases as these; for every-
thing that is studied or grasped by apprehension is true. 621b
Bailey seizes upon this statement because it appears to say that *epibole tes dianoias* is infallible. He makes the statement into an entirely general one by taking *theoroumenon* to mean "that which is grasped by the senses when 'looking' at the close view"; thus he makes it a general statement of the two sources of knowledge according to his view of Epicureanism: the close view, and the direct mental apprehension. But in fact *theoroumenon* must mean studied: the word has occurred 16 words before, precisely to distinguish what is studied theoretically from what is observed by the senses. Whatever this concluding sentence says, it is all about thought. However, it still appears to say that the processes of thought are infallible. The contribution of *doxa* is false, since what is grasped by thought is true. "Why is *doxa* liable to produce false results, while the other (epibole) can only give us what is true?" Bailey asks;24 and he answers, "with some hesitation", that it is because the mind moves by one epibole after another, from one clear and distinct concept to another, each of these concepts being clear in the same technical sense as that in which the unimpeded view of a near object is clear.

I think the clue to understanding this cryptic sentence of Epicurus lies in the passage quoted above.25 What we have in both passages is a contrast between the operation of *doxa*, and the *epibole* of the senses or the mind. The important thing is to realise the exact nature of the contrast. Bailey takes it to mean that *doxa* goes wrong, whereas *epibole* is always right. But we have seen in the earlier passage that *epibole* is responsible for dreams and illusions, as well as for truth-telling apprehensions. The point of the contrast is that when we experience a mental image, it always pictures accurately the *eidolon* or set of *eidola* which cause it. Error never arises because of a lack of correspondence between the mental picture and the
atomic configuration which caused it. The possibility of error (and of being right, too, we ought to add) arises only at the second stage, when doxa, a second movement of the mind, distinct from the epibole, pronounces upon the relation between the mental picture and the external world.

Epicurus should not use the word alethes of the primary impressions of the senses or the mind. It would be better to say they are neither true nor false. But it is quite clear that he does use alethes in this sense, since he is quoted as saying that "the illusions (phantasmata) of madmen and dream-visions are true". The explanation is added: "they are true because they move (the sufferer), and what does not exist does not cause movement".26

So I suggest that Epicurus is not saying, as Bailey thought, that doxa's inference from the seen to the unseen in this case is wrong, whereas the inference of epibole to the unseen is always right: he is saying that it must be doxa's inference to the unseen that is wrong in these cases, because the error never lies in the mental picture itself. He is not saying that direct mental apprehension infallibly tells the truth about the external world, but only that our mental images are not the level at which mistakes occur.

So, what are we left with?

An examination of all the evidence, of which the greater part has been discussed here, offers no ground for accepting Bailey's view of Epicurus.27 Epicurus did not claim to have some kind of direct insight which led to clear and distinct ideas about the structure of the world. He tried to present arguments for his basic propositions, based on the evidence of sense-perception. Admittedly, his arguments were extremely simple minded, for the most part. But I do not see any fundamental inconsistency in his position.
In particular, he is not liable to the charge laid against him by Cornford, that he dogmatically ruled out multiple explanations in his atomic theory, while accepting them in his meteorology. His method was to set up a pair of contradictories -- either there is void or there is not, either matter is infinitely divisible or it is not -- and then to present an argument for rejecting one of them.
Notes.

References are given as follows:

Epicurus Letter to Herodotus (Her.), Letter to Pythocles (Pth.),
Kyriai Doxai (KD), On Nature (Nat.), in the edition of G.
Arrighetti, Epicuro (Turin, 1960).

Philodemus On Signs in the edition by P. De Lacy, Philodemus:
On Methods of Inference (American Philological Association,
1941).

" The Greek Atomists and Epicurus (Oxford, 1929;
N. v., Russell and Russell, 1964) --- GAE.

1. GAE 265, 559-76.
2. GAE 264-65.
3. Pth. 87.
5. GAE 265.

7. E.g. the quotation at the top of GAE 565, which is not
"extracted" but rewritten: note the substitution of τὰς
for ἄλλας τινὰς.
8. Her. 49, 2 εἰς τὴν ὅτιν ἢ τὴν διάνοιαν. Her. 51, 2
καθ᾽ ὑμνοὺς γινόμεναν (on which see below). Lucretius 4, 722-
822.
9. Reiley (GAE 563) treats sentence A as an instance of ἐπι-
βολὴ τῶν αἰσθητηρίων, ignoring διάνοια for the moment. "This
is exactly," he says, "the idea of ἐπιβολὴν ὁποίας which Epicurus
has just been expounding in the preceding context." We get first
a mere passive sensation, but it is not until we have looked closely that we can be sure the image is clear; "ἐπιθέλη is required for the confirmation (or non-confirmation) of the δόξα founded on the original passive perception."

It is not true, however, that Epicurus has been expounding the idea of ἐπιθελής. He has been using the criterion of ἀντιμαρτύρης in sections 48-49; but that is a very different thing. He has been saying that there is nothing in our sense experience to contradict his statements about the εἰδῶλα that they are incomparably fine textured, move as swiftly as thought, and so on. Put there is nothing in the preceding context that warrants a distinction between the first passive sensation and the subsequent act of looking.

Bailey then argues (GAE 564-65) that sentence C is about normal, reliable sense perception. His method is to remain silent about the previous sentence, which is concerned with error, and to substitute a row of dots for ἡ καθ' ὑπόνους γίνομένων

Arrighetti puts sentence B in square brackets. But this seems to be only because he has accepted the wrong interpretation of C.

10. For the meaning of ἐγκατάλειμμα, see n. 14.

11. The words which follow these in the text are disputed. They fill out the meaning of "the addition made by doxa" by referring to the concepts of confirmation and non-confirmation. None of the likely readings would alter the logic of the passage as a whole; the important point is that sentence A is about reliable sense perception, sentence B is about error, and sentences C and D explain B.
12. The MSS have πρὸς ὅ (or ὅ) βάλλομεν. Bailey reads τοιαύτα προσβαλλόμενα with Usener. I have adopted the emendation of Schneider, followed also by Arrighetti.

13. The words τὴν φανταστικὴν ἐπιβολὴν are supplied here by all recent editors from 50, 11-12, where they are probably misplaced.

14. "The remaining effect" (ἐγκατάλειμμα) is mysterious. There is no doubt that in Epicurean theory the εἰδόλα leave some mark on the soul atoms -- presumably some more or less durable pattern of motion. This is probably what ἐγκατάλειμμα refers to (although there have been other interpretations of it). It would take too much space to examine the possibilities fully. I believe Epicurus is thinking of the role of πρόληψις in his theory of knowledge. See further Bailey GAE 245-47; K. Kleve, Gnosis Theon (Oslo; Symbolae Osloenses Fasc. Supplet. XIX, 1963) 23-29; D. J. Furley, Two Studies in the Greek Atomists (Princeton University Press, 1967) 202-08.

15. There is much obscurity in "the appearances seen as if in a picture (ἐν εἰκόνι)." Centaurs, Scyllas, Cerberuses, as in Lucretius 4, 732-33?

16. Note the similar argument in Lucretius 4, 750-51: "quatenus hoc simile est illi, quod mente videmus/ atque oculis, similis fieri ratione necessest." And 757-59 "nec ratione alia, cum somnus membra profudit;/ mens animi vigilet, nisi quod simulacra lacesunt/ haec eadem nostræ animos quae cum vigilamus."

The occurrence of this in Lucretius is a strong confirmation that we are now interpreting C correctly.


18. Her. 39, 3-7. The text is disputed, but none of the vari-
ations proposed would affect the present discussion.


20. Leucippus A 7 (Aristotle GC 325 a 4).

21. VIII 32 - IX 3 (p. 42). Lucretius' way of handling this argument is interesting. In I, 370-97, he gives reasons for rejecting the proposition that there can be motion without void. The second seems the better argument: if two flat bodies are in contact, surface to surface, and are then separated suddenly, then if a void space is impossible the air must fill the newly created gap instantaneously.

22. Her. 56-59. Lucretius 1, 599-634. See my Two Studies in the Greek Atomists 7-43 for a defence of the explanation given here.


24. GAE 569-70.

24a. I am grateful to Father T. J. Tracy, S. J., for some helpful comments on this passage.

25. Her. 50-51.


27. Other relevant passages are Phe. 35 and 38, KD XXIV, Nat. 29, 14-15.